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UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF PURE AND APPLIED MATHEMATICS

MODULE: BASIC MATHEMATICS AND APPLICATIONS IN ECONOMICS AND BUSINESS B – MAEB322 AND MAEB0B1

CAMPUS: APK

ASSESSMENT: SUPPLEMENTARY EXAMINATION

DATE: JANUARY 2018

ASSESSORS: MR W VAN REENEN
MS M NOUKO

INTERNAL MODERATOR: MS S RICHARDSON

DURATION: 2 HOURS

80

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: 12 (INCLUDING COVER PAGE)

INSTRUCTIONS:

- ANSWER ALL THE QUESTIONS IN PEN
- ALL GRAPHS MUST BE DRAWN IN PEN
- NO PENCIL ALLOWED
- NO TIPEX ALLOWED
- STATE ALL FORMULAS USED - MARKS ARE GIVEN FOR FORMULAS
- SHOW ALL THE NECCESARY CALCULATIONS
- IF NECESSARY, ROUND OFF TO TWO DECIMAL PLACES
- IF NECESSARY, INTEREST RATES ARE TO BE ROUNDED TO TWO DECIMAL PLACES AS A PERCENTAGE
- SCIENTIFIC CALCULATORS ARE ALLOWED
- FINANCIAL CALCULATORS ARE NOT ALLOWED

QUESTION 1 **[14]**

Given ;

Contraints: $\begin{cases} 0 \leq x \leq 20 \\ 0 \leq y \leq 30 \\ 10x + 30y \geq 360 \\ 40x + 10y \geq 400 \\ 45x + 50y \leq 2250 \end{cases}$ Objective Function: $Z = 300x + 150y$

1.1 Sketch the Feasible Region described by the constraints. [7]

1.2 Find all the corner points of the Feasible Region. [5]

1.3 Maximise the Objective Function. [2]

QUESTION 2 [10]

Differentiate the following functions. You do **NOT** have to simplify your answers.

2.1 $y = (8x^2 - 16)(20x + 4x^5)$ [2]

2.2 $y = \ln(4x^2 - 8x)^8$ [3]

2.3 $y = e^{5x^3+25x}$ [2]

2.4 $y = \frac{2-2x}{2x^2+4}$ [3]

QUESTION 3 [7]

Tanya and Rachel are B.Com Accounting graduates from UJ. Upon graduating, they started a business specialising in the design and manufacturing of a charm-bracelet, *The Jem*, especially for the student market. Tanya and Rachel have decided to employ a business analyst in order to aid them in optimising their business. The analyst determined the following economic functions:

$$Total\ Cost\ (TC) = 2q^2 + \sqrt[4]{q^6} + 5000 \qquad Price\ (P) = \frac{6}{q} + 6\sqrt{q}$$

Determine the:

3.1 Marginal Cost (MC) function. [1]	3.2 MC at $q = 100$. [1]
3.3 Average Cost (AC) function. [1]	3.4 AC at $q = 100$. [1]
3.5 Total Revenue (TR) function. [1]	3.6 Marginal Revenue (MR) function. [1]
3.7 MR at $q = 100$. [1]	

QUESTION 4 [9]

Rorisang purchased her first business for R2,500,000.00. Rorisang took out a loan for R2,500,000.00 at a good interest rate of 7.8% per year, compounded monthly, for a 20 year period. (Refer to Annexure A)

Determine:

4.1 The monthly payment. [2]

4.2 The interest contained in the 135^{th} payment. [2]

4.3 The principle outstanding after the 92^{nd} payment. [2]

4.4 The finance charge. [2]

4.5 The 100^{th} payment. [1]

QUESTION 5 [10]

The following data consists of the test scores out of 60 for a group of MAEB322-0B1 students:

19	5	15	10	10	11	13	15	17	18
20	4	26	27	30	5	31	34	36	37
40	20	5	5	46					

5.1 Complete the following class-based frequency table: [3]

Class	Count	Frequency	Relative Frequency
0-10			
11-20			
21-30			
31-40			
41-50			
51-60			
TOTAL			

5.2 Complete the following table: [3]

Mean	
Mode	
Median	

5.3 Construct a histogram using the frequency table from Question 5.1. [4]

Question 6 [4]

You have one coin and one die. You first throw the coin and then roll the die.

- Coin: H = Heads, T = Tails
- Die: 1, 2, 3, 4, 5, 6

6.1 Determine the sample space. [1]

6.2 Construct a Tree Diagram which represents the situation. Clearly indicate all outcomes and probabilities. [3]

Question 7 [10]

Given the following sample space S with events A, B and C:

$S = \{1, 2, 3, 4, 5, 6\}$ $A = \{1, 2, 3\}$ $B = \{4, 5, 6\}$ $C = \{1, 2, 3, 5\}$

7.1 Construct the Venn-Diagram which represents this situation. [4]

7.2 Determine:

a) $P(A)$ [1]

b) $P(C^{|})$ [1]

c) $P(A \cap B)$ [1]

d) $P(A) \cdot P(B)$ [1]

7.3 Are *A* and *C* are independent events? Motivate your answer. [2]

QUESTION 8 [6]

William wants to open a coffee bar. He approaches Noxi as a potential investor. If Noxi will provide an initial investment of R35,000.00, William will pay Noxi the following:

YEAR	CASH FLOW
2	R5,500.00
4	R10,000.00
6	R15,000.00

Assume an interest rate of 7.3%, compounded semi-annually.

8.1 Determine the net present value (NPV) of the cash flows. [5]

8.2 Is the investment profitable for Noxi? (**YES** OR **NO**) [1]

QUESTION 9 [10]

9.1 Thandeka is 25 and graduated from UJ. She has started her own company which trades in glass beads used for traditional embroidery. She wants to start a retirement fund and estimates that she will need R 9,000,000.00 when she retires at the age of 62. An investment firm offers her an interest rate of 6.5% per year on her capital. If the retirement fund pays out as a perpetuity, what would the first payment be? **[2]**

9.2 Peter's investment of R5,000.00 grew to R10,500.00. The interest rate for this investment, compounded monthly, was 8.5%. How many years did it take for Peter's investment to mature? (Ignore leap years and round your answer to the nearest year). **[3]**

9.3 *Truck-X* wants to replace their light vehicle fleet in 4 years' time with new electric vehicles at an estimated R10,000,000.00. They want to set up a sinking fund for the new purchase. *ABC Bank* offers *Truck-X* a savings option, where they will make payments at the start of each quarter and will earn interest at a rate of 6%, compounded quarterly. Determine the required quarterly payment into this savings option. **[3]**

9.4 Convert a nominal interest rate of 9%, continuously compounded, to an effective rate. **[2]**

End of Assessment – Total Marks: 80

ANNEXURE A

$R\frac{r}{m}\left[\frac{1-\left(1+\frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}}\right]$	$R\left[1-\frac{r}{m}\times\frac{1-\left(1+\frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}}\right]$	
$nmR-A$	$R\left[\frac{1-\left(1+\frac{r}{m}\right)^{-nm}}{\frac{r}{m}}\right]$	$R\left[\frac{1-\left(1+\frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}}\right]$

Use this page if you want to redo a question. Please indicate clearly at the question that the answer is here.